Published in final edited form as:

Dev Sci. 2018 May ; 21(3): e12566. doi:10.1111/desc.12566.

Young Children Discover How to Deceive in 10 Days: A Microgenetic Study

Xiao Pan Ding^{1,4}, Gail D. Heyman^{2,4}, Genyue Fu^{3,4}, Bo Zhu⁴, and Kang Lee^{4,5,*}

¹Department of Psychology, National University of Singapore

²Department of Psychology, University of California, San Diego

³Department of Psychology, Hangzhou Normal University

⁴Department of Psychology, Zhejiang Normal University

⁵Dr. Eric Jackman Institute of Child Study, University of Toronto

Abstract

We investigated how the ability to deceive emerges in early childhood among a sample of young preschoolers (Mean age = 34.7 months). We did this via a 10-session microgenetic method that took place over a 10-day period. In each session, children played a zero-sum game against an adult to win treats. In the game, children hid the treats and had opportunities (10 trials) to win them by providing deceptive information about their whereabouts to the adult. Although children initially showed little or no ability to deceive, most spontaneously discovered deception and systematically used it to win the game by the tenth day. Both theory of mind and executive function skills were predictive of relatively faster patterns of discovery. These results are the first to provide evidence for the importance of cognitive skills and social experience in the discovery of deception over time in early childhood.

Deception is a ubiquitous human behavior that opens up limitless possibilities for obtaining social and material benefits (Barnes, 1994). Despite the significance of this ability, little is known about its initially discovery and the roles that children's social experience and cognitive skills play in its emergence. The present study aimed to fill this major gap by closely observing the process in which children discover how to deceive others over a period of 10 days. This was done in order to test the hypothesis that both cognitive skills and social experience play an important role in this discovery process (the *Cognitive-Social Hypothesis*).

Few children are able to deceive others before 3.5 years of age (Lee, 2013). One possible explanation might be that they lack the necessary executive function and theory of mind skills to do so. Both skills are known to develop rapidly from 3 years onward (Diamond, Carlson, & Beck, 2005; Gopnik & Astington, 1988; Perner, Leekam, & Wimmer, 1987; Sabbagh, Xu, Carlson, Moses, & Lee, 2006; Wellman & Liu, 2004). To engage in deception,

Correspondence concerning this article should be addressed to: Kang Lee, Dr. Eric Jackman Institute of Child Study, University of Toronto, Canada, kang.lee@utoronto.ca.

children must have executive function abilities to keep track of both truthful and false information and be able to inhibit revealing truthful information. They must also represent the minds of others and have some understanding that people can be misled to have false beliefs. Both skills indeed play an important role in children's decision to deceive after they have already discovered deception (Carlson, Moses, & Hix, 1998; Ding, Wellman, Wang, Fu, & Lee, 2015; Evans & Lee, 2013; Hala & Russell, 2001; Talwar & Lee, 2008). Of interest in the present study is whether these skills might also play an important role in the initial discovery of deception among young children.

Social experience may also play an important role in the development of children's deceptive abilities. Prior research suggests that parenting styles and practices are predictive of children's lie-telling behavior (Lavoie, Leduc, Crossman, & Talwar, 2016; Ma, Evans, Liu, Luo, & Xu, 2015; Popliger, Talwar, & Crossman, 2011). For example, children who were taught by parents that lying is sometimes acceptable told significantly more lies to protect themselves than children who were taught that lying is never acceptable (Lavoie, Leduc, Crossman, & Talwar, 2016). There has also been one quasi-experimental study suggesting that social experience can have an impact on these abilities: Talwar and Lee (2011) tested the effects of exposure to a punitive school environment on 3- and 4-year-old children's tendency to lie to cover up their own transgressions using a temptation resistance paradigm. They found that children who attended a punitive school were more likely to lie than were children who attended a non-punitive but otherwise highly similar school. Through their personal experiences and social observations, it is likely that the children in the punitive schools came to understand that lying to cover up misdeeds could allow them to avoid painful consequences. However, what the African children in the punitive school experienced was extreme and does not represent the typical social experience of most children. Given that most children in typical and non-punitive environments are able to deceive after 3.5 years of age (Lewis, Stanger, & Sullivan, 1989; Talwar & Lee, 2002, 2008; Warneken & Orlins, 2015), it may be that any social experiences where the connection between deception and personal gain is salient may promote such discovery. No experimental study has ever tested this intriguing possibility.

To bridge this gap in the literature, we conducted the present study by targeting children of around 36 months. The reason we focused on this particular age was that the existing studies have shown that most children at this age cannot yet deceive, but they may already have the necessary theory of mind and executive functioning skills in place to allow them to do so (Lee, 2013). In the present study, children played a zero-sum game against an adult experimenter that involved a form of hide and seek. We used this approach because it has been used successfully in previous deception research with older children (Ding et al., 2015; Reyes-Jaquez & Echols, 2015; Russell, Mauthner, Sharpe, & Tidswell, 1991; Yi et al., 2014).

In the present game, which was played for 10 sessions over a 10-day period excluding weekends, the child, acting as a hider, hid a desirable treat. The experimenter, acting as the seeker, had one chance to find the treat. The rule was that if the experimenter found the treat, she would get to keep it, but that if the experimenter did not find the treat, the child would get to keep it. On each trial, children hid a treat in one of two cups when the experimenter

was not looking and then the experimenter asked the child where the treat was hidden. If the child responded truthfully, the confederate retrieved the treat and won the trial. If the child responded deceptively by indicating the empty cup, the experimenter searched the empty cup and lost the treat, which resulted in the child winning the treat. Thus, the present zero-sum game created a highly competitive situation where deception leads to personal gain and truthfulness leads to personal loss.

To closely examine how children discover deception, we used a microgenetic method, which is ideally suited for our research purpose (Flynn & Siegler, 2007). This is a short-term longitudinal method that involves dense observations of behavior, over a short period of time, to allow for close and fine-grained tracking of behavioral changes over time. This method opens up the possibility of answering basic questions about how developmental change occurs that cannot be answered with traditional cross-sectional and longitudinal designs (Luwel, Siegler, & Verschaffel, 2008; Siegler & Chen, 1998; Siegler, 2006). Furthermore, this approach offers an excellent opportunity to investigate individual differences in patterns of change (Siegler, 2006). In keeping with the general principles of the microgenetic method (Luwel et al., 2008), we tested children repeatedly and monitored their behaviors over a short period.

As noted previously, of primary interest in using the microgenetic method was to test the Cognitive-Social Hypothesis, that both cognitive skills and social experience play an important role in children's discovery of how to deceive others. Specifically we tested whether theory of mind and executive function capacities might help children to learn from social experience that highlights the benefits of deception. If this hypothesis is correct, experiences of losing or winning a zero-sum game children should lead to higher rates of learning to deceive among children with relatively higher levels of these skills.

Methods

Participants

We planned to recruit 100 children and succeeded in recruiting 99 of them to participate in the first session of the study ($M = 34.6$ months, from 27.2 months to 40.7 months, $SD = 3.5$, 48 boys and 51 girls). All children were Han Chinese and were native speakers of Mandarin. Children were from two different preschools located in an eastern city of P.R. China. Socioeconomic data was not collected on individual participants, but school officials reported that they served families with varying socioeconomic backgrounds in terms of parental income, occupation, and educational levels. Informed consent was obtained from all parents or legal guardians and oral assent was obtained from all child participants. Twelve children were excluded from the final sample because they were unable to complete all of the 10 sessions due to illness or absence and 3 children stopped giving their oral assent after the first session. The final sample thus included 84 children ($M = 34.7$ months, from 27.6 months to 40.7 months, $SD = 3.5$, 43 boys and 41 girls).

Procedure

Children were seen individually in a quiet room of their preschools and were seated at a small table. After a warm-up task, they played 10 trials of a zero-sum “I win you lose” hide and seek game (described below) across 10 sessions that took place on 10 consecutive days excluding weekends. During the first session, children were also given cognitive assessments to measure their executive function (EF) and theory of mind (ToM) skills.

Zero-sum hide and seek game—On Day 1 only, children first selected their favorite type of treat from a selection presented in a basket. Their selection was then used as the prize children could win on each trial throughout all 10 sessions of the experiment.

Also, on Day 1 only, children first played a 3-trial warm-up game that involved no deception. The experimenter hid a treat in one of two cups and then asked children to guess where it was. If children guessed correctly, they were declared a winner and received the treat. In contrast, if children guessed incorrectly, they were told that they lost the game and that the experimenter got to keep the treat. After the warm-up game, children engaged in 10 trials of the formal zero-sum game. In this game, children had the opportunity to win treats if they engaged in deception. Otherwise, they would lose the treats. The experimenter first explained the rules of the zero-sum game to participants. They were told to act as a hider by concealing a treat in the one of the two cups when the experimenter closed her eyes. They were also told that the experimenter would act as the seeker and had one chance to find the treat. Participants were further told that if the experimenter found the treat, they would lose the treat and she would get to keep it, but that if the experimenter did not find the treat, they would get to keep it. The experimenter only told children that their task was to compete with the experimenter to win treats, but no information about strategies for winning was provided.

After describing the rules of the game, the experimenter closed her eyes and told children to hide the treat in one of two cups and to let the experimenter know when they were finished. After children announced that the hiding was complete, the experimenter opened her eyes and asked, “Where did you hide the treat?” After this prompt, children either verbally or nonverbally (e.g., pointing) referred to one of the two cups. The experimenter then looked inside whichever cup the child referred to. Whenever children indicated the correct cup, she said, “I found it”. She then took the treat and said, “I won and you lost! It is my treat now.” After taking the treat, the experimenter said: “Let’s play again.” Whenever children engaged in deception by indicating the empty cup, the experimenter said, “It’s not here”. She then expressed disappointment and said, “I lost and you won! It is your treat now.” After giving the treat to the child, the experimenter said: “Let’s play again.” The number of trials out of 10 in which children engaged in deception was used to compute a *deception score* each session that ranged from 0 to 10 and converted into a percentage. At the end of the session all children received a sticker for participation.

From Day 2 until Day 10 children just played the formal zero-sum game for 10 trials. Only one experimenter ran the game, and this was always the same person. The experimenter did not remind children of the rules of the game or of their prior performance.

Executive functioning (EF) task—Day-night task was administered on Day 1 as the EF task (Gerstadt, Hong, & Diamond, 1994). Children were shown 16 cards sequentially with either a sun or a moon on them and were instructed to say “day” when they saw a picture of a moon and “night” when they saw a picture of a sun. If the child hesitated, the experimenter prompted the participant by saying, “What do you say for this one?” The experimenter never said the words “night” or “day” as a prompt. During the test, no feedback was given. All children received a proportion correct score that ranged from zero to one.

Theory of Mind (ToM) task—The false contents and location change tasks were administered on Day 1 too (Wellman & Liu, 2004). The wording of the false contents task was as follows: “See this box (pointing to a crayon box). This is a crayon box. Now here is Xiao Fang, she is cleaning up the classroom and puts some crackers in the empty crayon box.” There were two target questions for the false contents task: (1) content false belief (“When the other children come back in from playing outside, what will they think is in the crayon box?”); and (2) own belief (“What do you think is really in the crayon box?”). The final question was administered to test for participants’ memory of the story: (3) memory (“Did the children who were playing outside see Xiao Fang put the crackers in the box?”).

The wording of the location change task was the following: “Xiao Ming is using the markers before recess over at the art table. Xiao Ming goes outside to play and the teacher puts the markers in the cabinet.” There were two target questions for the location change task: (1) location false belief (“When Xiao Ming comes back, where will she look for the markers?”); and (2) own belief (“Where do you think the markers are really located?”). As above, the third item was administered to test for participants’ memory of the story: (3) memory (“Did Xiao Ming see where the teacher put the markers?”). For the analyses conducted with the false belief tasks, a five-point scale was created based on responses to the two target questions (the false belief question and the own belief question) in both the false contents as well as the location change tasks (0 = none passed, 4 = all passed). While the “own belief” questions are often used as inclusion criteria, we used these questions to create the false belief scale to provide more than two data points (see Killen, Mulvey, Richardson, Jampol, & Woodward, 2011).

Results

Preliminary analyses revealed no gender differences in any of the measures we used. Thus, the following analyses were performed with the boys’ and girls’ data combined.

Overall pattern of children’s discovery of deception in 10 days

First, to examine the overall pattern of children’s discovery of deception, we obtained the mean deception scores in each of the 10 days and the 95% confidence intervals (Figure 1). As shown in Figure 1, children on average only deceived on 12% of the 10 trials on the first session, which was significantly below the 50% chance level, indicating that the children were truthful most of the time. On the second day, their mean deception score reached the chance level, and on the fourth day, they deceived on 64% of the trials, which was significantly above chance. On the tenth day, they deceived 84% of the time, also significantly above chance.

Second, we conducted a repeated measure ANOVA with time (from the first session to 10th session) as the within-subject factor, children's age, EF and ToM scores (continuous) as the between-subject factors, and children's deception score as the dependent variable. Only the main effects of time, EF, and ToM were significant ($F(9,74) = 96.32, p = .000, \eta^2 = .55$; $F(1,80) = 8.16, p = .005, \eta^2 = .09$; $F(1,80) = 5.27, p = .024, \eta^2 = .06$, respectively). Children engaged in deception more frequently over the course of the 10 sessions, and higher executive function and theory of mind scores were associated with greater deception scores.

Different developmental patterns of children's discovery of deception

An additional goal of our research was to assess potential individual differences. In order to address this issue, we first inspected the individual change patterns of all children over the 10 sessions (Figure 2). We discovered that the children ($n = 30, M_{age} = 34.4 \pm 2.8$ months) who were able to deceive at least once on the first session (we henceforth refer to it as the *fast-discovery* group) had a unique pattern of change in deception scores that differed from the rest of the children. The latter did not deceive at all and thus lost all the treats. On the first day, the *fast-discovery* group already deceived on about 35% of the trials on average, which was significantly below chance. On the second day, they deceived 100% of the time and had the same perfect deception scores for the rest of sessions.

For the remaining children ($n = 54$), we performed a two-step clustering analysis using the children's deception scores for each of the 10 sessions to identify subgroups statistically. The Euclidean distance-based similarity method was used as the distance measure and Schwarz's Bayesian Criterion (BIC) was used as a clustering criterion. The clustering analysis produced a two-cluster model with the lowest BIC being 333.29 and the highest ratio of distance measures being 1.85. Based on these results, we divided children into two groups according to their patterns of change in deception scores (Figure 2). One group of the children (henceforth referred to as the *intermediate-discovery* group) showed a fast-change pattern ($n = 32, M_{age} = 35.6 \pm 3.5$ months). Although individuals in this group never deceived in the first session and consequently lost all of the treats on that session, with increased experience with the game, they quickly discovered deception: They used it 67% of the time on average on the fourth day, which was significantly above the chance level, and by the eighth day, their deception scores were perfect. The other group of the children (henceforth referred to as the *slow-discovery* group) showed a slow-change pattern ($n = 22, M_{age} = 33.5 \pm 3.8$ months). This slow-discovery group showed small increases in deception scores over the 10 days: On average, they only deceived 10% of the time on the fourth day (below the chance level), and 41% on the tenth day (not significantly different from the chance level).

To examine whether the three groups differed in terms of age, EF, and ToM scores, we conducted three one-way ANOVAs with the grouping (the *fast*, *intermediate* and *slow-discovery* groups) as the independent variable, and age in months, EF and ToM scores as dependent variables, respectively (see Table 1). The three groups differed significantly in terms of their EF and ToM scores (EF: $F(2,81) = 7.01, p = .002, \eta^2 = .15$; ToM: $F(2,81) = 3.59, p = .032, \eta^2 = .08$). A priori contrasts with the *slow-discovery* group as the reference revealed that the mean EF score of the *fast-discovery* group (*Mean difference* = 2.47, $p = .$

001) and that of the *intermediate-discovery* group (*Mean difference* = 2.05, $p = .004$) were significantly higher than that in the *slow-discovery* group. Also, the mean ToM score of the *fast-discovery* group was significantly higher than that in the *slow-discovery* group (*Mean difference* = .72, $p = .009$). There was no significant difference of age among these three groups, $F(2,81) = 2.59$, $p = .081$, $\eta^2 = .06$.

To examine the unique contributions of the EF and ToM scores to the three patterns of the discovery of deception, a multinomial logistic regression was conducted, with the three grouping (the *fast*, *intermediate* and *slow-discovery* groups) as the predicted variable, and age in months, EF and ToM scores as predictor variables. Again, we used the *slow-discovery* group as the reference group. The results showed that the whole model was significant, $\chi^2(6,84) = 21.17$, *Nagelkerke* $R^2 = .25$, $p = .002$.

Inspection of the final model revealed that the EF and ToM scores significantly accounted for differences between the *fast-discovery* and *slow-discovery* groups above and beyond the common contributions of the age, EF, and ToM variables (EF: $\beta = 2.75$, *Wald* = 5.28, $p = .022$, *OR* = 15.67, 95% CI = [1.50, 163.86]; ToM: $\beta = .75$, *Wald* = 4.98, $p = .026$, *OR* = 2.12, 95% CI = [1.10, 4.10], respectively). Additionally, the children in the *fast-discovery* group had significantly higher EF and ToM scores than the children in the *slow-discovery* group, with both skills uniquely contributing to their fastest pattern of discovery of deception. The mean estimate of population odds ratio suggests that with every 10% increase in the EF accuracy score, children would be 1.57 times more likely to belong to the *fast-discovery* group than the *slow-discovery* group. Also, with each 1-point increase in ToM score, children would be 2.12 times more likely to belong to the *fast-discovery* group than the *slow-discovery* group.

Inspection of the final model revealed that compared to the *slow-discovery* group, the EF scores significantly accounted for differences between the *intermediate-discovery* and *slow-discovery* groups above and beyond the common contributions of the age, EF, and ToM variables ($\beta = 3.28$, *Wald* = 7.16, $p = .007$, *OR* = 26.54, 95% CI = [2.40, 293.19]). The children in the *intermediate-discovery* group had significantly higher EF scores than the children in the *slow-discovery* group with the EF skills uniquely contributing to their faster pattern of discovery of deception. The mean estimate of the population odds ratio suggests that with every 10% increase in the EF accuracy score, children would be 2.65 times more likely to belong to the *intermediate-discovery* group than in the *slow-discovery* group.

Discussion

The present study used a microgenetic method to closely track how children of about 36 months of age discover deception in a competitive zero-sum game. We found that most children initially consistently provided truthful information about the whereabouts of the treat they hid and thus repeatedly lost the game to the experimenter. However, after only a few more sessions, most children discovered deception and used it to win the game.

Previous work had documented that exposure to a highly punitive environment is associated with high rates of lying (Talwar & Lee, 2011), but before the present research it was unclear

whether less extreme social experiences might have similar effects, and whether such experiences could have an impact on younger children who start off with little or no ability to deceive. What the punitive environment reported in Talwar and Lee (2011) and the competitive game in the current study have in common is that children have repeated experiences with a situation where truthfulness leads to personal losses and deception leads to personal gains. Thus, self-interest incentives seem to play a special role in the discovery of deception (see Reyes-Jaquez & Echols, 2015). The unique contribution of the present study is that we showed that by exposing young children to a competitive situation, many quickly and spontaneously discovered deception as a viable strategy for personal gain.

However, in our study, not all children discovered deception at the same rapid rate. Capitalizing on the short-term longitudinal data afforded by the microgenetic method, we found three groups of children who followed different patterns. First was the *fast-discovery* group, who used deception at below a chance level during the first session, but immediately discovered its usefulness and used it 100% of the time from the second day onward. Second was a *intermediate-discovery* group, who initially did not deceive at all but steadily increased their use of deceit until the eighth day, when they used it 100% of the time. Third was a *slow-discovery* group, who, like the *intermediate-discovery* group, initially did not deceive at all, but unlike that group, never deceived at a level above chance.

The three discovery groups differed in terms of both their executive function and theory of mind skills at the beginning of the study. Relative to the *slow-discovery* group, those in the *fast-discovery* group had significantly higher levels of both skills, whereas those in the *intermediate-discovery* group had significantly higher levels of executive function skills. Thus, it appears that the social experience effects that give rise to children's discovery of deception depend on these skills. Once children reach a necessary level, they can discover deception virtually overnight (as was the case of the *fast-discovery* group), or in just over a few days (as was the case of the *intermediate-discovery* group). In contrast, when children are relatively poor at both skills, their path to discover deception is much slower.

Our finding that executive function and theory of mind skills play an important role in young children's discovery of deception supports the *Cognitive-Social Hypothesis* that both these skills and social experiences are needed for young children to discover deception for the first time. Further, our results are highly consistent with the robust findings in the developmental literature that both theory of mind and executive function skills play an important role in older children's decision to deceive after they have already discovered deception (Carlson, Moses, & Hix, 1998; Talwar & Lee, 2008; for a review, see Lee, 2013). Taken together, the present findings and those from existing studies suggest that these two skills play a crucial role in both the emergence and further development of deception in children.

There are several limitations and unanswered questions that should be noted. The present study only focused on one type of deception – commonly referred to as antisocial lie telling or deception for personal gain. It remains unknown how children could learn to tell other types of lies, such as lying for politeness purposes or for the collective good (Fu, Evans, Wang, & Lee, 2008). The scope of what children learned from participation in our zero-sum game still needs to be determined as well. It is possible that their learning was highly context

dependent and could only be used to win that game, but it is also possible that they learned something more general that could be applied more broadly.

Another limitation of our research was that we only used false-belief tasks to assess ToM ability, and the Day-night task to assess EF ability. Further research should include more diverse measures. For example, it may be that other aspects of theory of mind such as the ability to understand the similarities and differences between their own mental states (e.g., desires, knowledge) and those of other people contributes to children's deceptive abilities. Also, executive functioning measures could be expanded to include such skills as planning and working memory that are known to play an important role in older children's lying (Evans & Lee, 2011).

There are also important unanswered questions about the effects of the timing of competitive social experiences. For example, would young children discover deception faster if our sessions were held on an even more compressed schedule, such as twice daily? Also of interest will be to determine whether the *slow-discovery* group simply needed more experience playing the zero-sum game to reach the same endpoint as individuals in the other groups. Suggestive of this possibility is the fact that they showed an increase in the use of deception over the 10-day period, even though they never performed at a level better than chance. Given that theory of mind and executive function skills typically develop only over a protracted period of time, this raises the intriguing possibility that additional experience with a competitive game could compensate for the lack of these skills.

In summary, the present results provide evidence that social experience with playing competitive zero-sum games can influence young children's discovery of deception, and that the rate at which children learn from such experience depends on their cognitive capacities to represent mental life, as well as to keep track of both truthful and false information and be able to inhibit revealing truthful information. The present findings also demonstrate that it is possible for a fundamental social-cognitive skill to develop over a very short period of time and illustrate the potential of microgenetic methods to track such changes as they happen.

Acknowledgments

The present study was supported by grants from the National Natural Science Foundation of China (31371041, 31470993 & 31400898), Zhejiang Provincial Natural Science Foundation of China (LQ14C090001), SSHRC and NIH (R01 HD047290).

References

- Barnes, JA. A pack of lies: Towards a sociology of lying. New York: Cambridge University Press; 1994.
- Carlson SM, Moses LJ, Hix HR. The role of inhibitory processes in young children's difficulties with deception and false belief. *Child Development*. 1998; 69(3):672–691. [PubMed: 9680679]
- Diamond A, Carlson SM, Beck DM. Preschool children's performance in task switching on the dimensional change card sort task: Separating the dimensions aids the ability to switch. *Developmental Neuropsychology*. 2005; 28(2):689–729. [PubMed: 16144433]
- Ding XP, Wellman HM, Wang Y, Fu G, Lee K. Theory of mind training causes honest young children to lie. *Psychological Science*. 2015; 26(11):1812–1821. [PubMed: 26431737]

- Evans AD, Lee K. Verbal deception from late childhood to middle adolescence and its relation to executive functioning skills. *Developmental Psychology*. 2011; 47(4):1108–1116. [PubMed: 21553958]
- Evans AD, Lee K. Emergence of lying in very young children. *Developmental Psychology*. 2013; 49(10):1958–1964. [PubMed: 23294150]
- Flynn E, Siegler R. Measuring change: Current trends and future directions in microgenetic research. *Infant and Child Development*. 2007; 16(1):135–149.
- Fu G, Evans AD, Wang L, Lee K. Lying in the name of the collective good: A developmental study. *Developmental Science*. 2008; 11(4):495–503. [PubMed: 18576957]
- Gerstadt CL, Hong YJ, Diamond A. The relationship between cognition and action: Performance of children 3.5–7 years old on a stroop- like day-night test. *Cognition*. 1994; 53(2):129–153. [PubMed: 7805351]
- Gopnik A, Astington JW. Children's understanding of representational change and its relation to the understanding of false belief and the appearance-reality distinction. *Child Development*. 1988; 59(1):26–37. [PubMed: 3342716]
- Hala S, Russell J. Executive control within strategic deception: A window on early cognitive development? *Journal of Experimental Child Psychology*. 2001; 80(2):112–141. [PubMed: 11529671]
- Killen M, Lynn Mulvey K, Richardson C, Jampol N, Woodward A. The accidental transgressor: Morally-relevant theory of mind. *Cognition*. 2011; 119(2):197–215. [PubMed: 21377148]
- Lavoie J, Leduc K, Crossman AM, Talwar V. Do as I say and not as I think: Parent socialisation of lie-telling behaviour. *Children and Society*. 2016; 30(4):253–264.
- Lee K. Little liars: Development of verbal deception in children. *Child Development Perspectives*. 2013; 7(2):91–96. [PubMed: 23687515]
- Lewis M, Stanger C, Sullivan MW. Deception in 3-year-olds. *Developmental Psychology*. 1989; 25(3):439–443.
- Luwel K, Siegler RS, Verschaffel L. A microgenetic study of insightful problem solving. *Journal of Experimental Child Psychology*. 2008; 99(3):210–232. [PubMed: 17919651]
- Ma F, Evans AD, Liu Y, Luo X, Xu F. To lie or not to lie? The influence of parenting and theory-of-mind understanding on three-year-old children's honesty. *Journal of Moral Education*. 2015; 44(2):198–212.
- Perner J, Leekam SR, Wimmer H. Three-year-olds' difficulty with false belief: The case for a conceptual deficit. *British Journal of Developmental Psychology*. 1987; 5:125–137.
- Popliger M, Talwar V, Crossman A. Predictors of children's prosocial lie-telling: Motivation, socialization variables, and moral understanding. *Journal of Experimental Child Psychology*. 2011; 110(3):373–392. [PubMed: 21663918]
- Reyes-Jaquez B, Echols CH. Playing by the rules: Self-interest information influences children's trust and trustworthiness in the absence of feedback. *Cognition*. 2015; 134:140–154. [PubMed: 25460387]
- Russell J, Mauthner N, Sharpe S, Tidswell T. The "Windows Task" as a measure of strategic deception in preschoolers and autistic subjects. *British Journal of Developmental Psychology*. 1991; 9(2):331–349.
- Sabbagh MA, Xu F, Carlson SM, Moses LJ, Lee K. The development of executive functioning and theory of mind: A comparison of Chinese and U.S. preschoolers. *Psychological Science*. 2006; 17(1):74–81. [PubMed: 16371147]
- Siegler RS. Microgenetic analyses of learning. *Handbook of child psychology*. 2006; 2:464–510.
- Siegler RS, Chen Z. Developmental differences in rule learning: A microgenetic analysis. *Cognitive Psychology*. 1998; 36:272–310.
- Talwar V, Lee K. Development of lying to conceal a transgression: Children's control of expressive behaviour during verbal deception. *International Journal of Behavioral Development*. 2002; 26(5):436–444.
- Talwar V, Lee K. Social and cognitive correlates of children's lying behavior. *Child Development*. 2008; 79(4):866–881.

- Talwar V, Lee K. A punitive environment fosters children's dishonesty: A natural experiment. *Child Development*. 2011; 82(6):1751–1758. [PubMed: 22023095]
- Warneken F, Orlins E. Children tell white lies to make others feel better. *British Journal of Developmental Psychology*. 2015:259–270. [PubMed: 25773019]
- Wellman HM, Liu D. Scaling of theory-of-mind tasks. *Child Development*. 2004; 75(2):523–541. [PubMed: 15056204]
- Yi L, Fan Y, Li J, Huang D, Wang X, Tan W, ... Lee K. Distrust and retaliatory deception in children with autism spectrum disorder. *Research in Autism Spectrum Disorders*. 2014; 8(12):1741–1755.

Research highlights

- We investigated how the ability to deceive emerges in early childhood among a sample of young preschoolers.
- Although children initially showed little or no ability to deceive, some young children can discover how to deceive after playing a competitive game for just a few days.
- Both theory of mind and executive function skills are associated with faster patterns of discovery.
- These results are the first to provide evidence for the importance of cognitive skills and social experience in the discovery of deception over time in early childhood.

Figure 1.

The mean deception scores in percent across 10 sessions (Dash lines represent the 95% confidence intervals)

Figure 2.
Three developmental patterns of children's discovery of deception (Dash lines represent the 95% confidence intervals)

Table 1

Mean EF score, ToM score, and age by group

	EF	ToM	Age in months
<i>Fast-discovery</i> group	.77 (.25)	1.53 (.90)	34.44 (2.76)
<i>Intermediate-discovery</i> group	.81 (.21)	1.19 (1.03)	35.64 (3.48)
<i>Slow-discovery</i> group	.56 (.29)	.81 (.91)	33.48(3.84)

Note. Standard deviations are in parentheses.